Defining the Relevant Product Market: An Application of Price Tests to the Beer Market in Barbados

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1. Introduction

Defining the relevant market is the cornerstone of competition law enforcement. It is the first step taken by competition authorities to assess the conduct of business enterprises. By delineating the relevant market, national competition authorities can: establish the boundaries of competition and the competitive constraints which may exist on the practices of one or more business enterprises; calculate the market shares or undertake any necessary analysis to conclude whether a business enterprise in a market is dominant; and build a framework upon which national competition rules are applied. Given its importance, competition authorities across the world have over the years used several methods to help them define the relevant market.

The most used method by competition authorities across the world to delineate the relevant market is the Small but Significant Non-transitory Increase in Price (SSNIP) test.[1] This test examines substitutability and considers how interchangeable products are to each other by assessing the perspectives of customers or the demand side of the market when factors such as price, product usage and the characteristics of the product. In some cases, during the conduct of the SSNIP test the competition authority will consider the supply side of the market. This involves identifying producers that are able to switch to producing another product in a period short enough with no significant cost being incurred. Some of the more mature competition jurisdictions place a heavy emphasis on developing sophisticated demand models to apply the SSNIP test. However, these types of analyses often require a wide range of data.

Besides the SSNIP test, some competition authorities use other methods to help them define the relevant market. One such approach is a group of analyses called price tests, which include: correlation analysis[2]; stationarity or unit root tests;[3] cointegration;[4] and Granger causality.[5] These tests are convenient tools since the only information needed for their implementation is a suitable number of observations of price data. To a large extent, the usage of these tools also depends on the specificities of the case in question and the time constraint of the competition assessment being conducted.

This paper examines the relevant product market in the beverages sector in Barbados. Specifically, the paper applies price tests to examine if, for competition law enforcement purposes in the country, beer is a separate relevant product market from rum and soft drinks. In doing so, the paper follows the methods of Zipitría (2009), who also used price tests to conclude that beer is a separate product market from wine and soft drinks in Uruguay. By comparing the results of price tests applied to data from Uruguay and Barbados, the paper also examines the robustness of the results of price tests to different datasets.

It is also important to note that, based on their competition law enforcement practices and using the SSNIP test, the European Union (EU) and the United States (US) consider beer as a distinct

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[1] The SSNIP test was first set out in 1982 US Department of Justice Merger Guidelines.

[2] For example Case COMP/M.4799 OMV/MOL

[3] For example Case COMP/M.5153 Arsenal/DSP

[4] For example Case IV/M619 [1997] Official Journal of the European Communities L11/30 and Case COMP/M2187 [2000]

[5] For example Case IV/M315 [1994] Official Journal of the European Communities L102/15

product market from other beverages.[6] If the conclusions on the relevant product market derived from the price tests are consistent with the decisional practices in the US and the EU, it would then prove that in cases where price data is sufficient, the national competition authority in Barbados, and perhaps competition authorities within the wider Caribbean Community (CARICOM), can rely on price tests to build a framework to enforce national competition rules.

The paper is therefore organised as follows. Section II provides the data and methodology used in the paper. Section III presents the results of the price tests conducted, while section IV concludes.

2. Methodology and Data

2.1 Methodology

The first test used in this study is the Pearson's correlation test. Stigler and Sherwin (1985) were the first to propose the use of the correlation test to define the relevant market. They argued that the prices of products belonging to the same market move in the same direction and with the same intensity (see Motta, 2008). Therefore, if the prices of all potential substitutes are moving with the same intensity in the same direction, then these products are most likely belong to a single relevant product market.

In applying the correlation test, this study considered three important factors. First, to obtain coherent results the data series being analysed must be stationary. As the derived t-statistic is normally distributed and stationary, if series are non-stationary they need to be differentiated enough times so they become stationary or I(0). Hence, stationarity tests are conducted on the three average monthly price data series before implementing the correlation test.

The second factor considered, which relates to competition enforcement, concerns how high correlation coefficients have to be for two products to belong in the same relevant market. In EU competition case law, the European Commission uses the reference value of +0.8. If the correlation coefficient is below the reference point, the European Commission concludes that two products do not belong to the same relevant market. On the other hand, any correlation coefficient equal to or above +0.8 suggests there is a high probability that the two products being analysed belong to the same relevant market. This paper, therefore, adopts the EU approach when interpreting the correlation coefficients for the average prices of the three categories of beverages in Barbados.

The third factor considered is that common elements shared between two data series could lead to spurious correlations. In this case, if the three beverage categories share similar input costs that contribute to their price formation, this could cause misleading, high correlations. This study considers inflation as a common element and addresses this by converting the nominal average monthly prices to real or deflated prices as stated in the previous section. However, if the test results show a high positive correlation between the price data series, an additional correlation

[6] For the EU see the decisions of the European Commission in COMP/M.3372 (Carlsberg/Holsten); COMP/M.3032 (Interbrew/Brauergilde); COMP/M.2569 (Interbrew/Beck's): COMP/M.2877 (Carlsberg/Brauholding Int./JV): COMP/M.2387 (Heineken/Bayerische Brauholding/JV); COMP/M.2152 (S&N/Centralcer). For the US see United States v. Falstaff Brewing Corp., 410 U.S. 526 (1973)

test will be undertaken after running an Ordinary Least Squares (OLS) regression for each price data series on the logs of the retail price index. Stigler and Sherwin (1985) suggested that the residuals of such OLS regressions can provide a "purged" data series from which the correlation test could then be conducted.

The second test conducted in this study is the stationarity or unit root test. Forni (2002), who proposed this test, argued that if two products belong in the same market, their relative price must be stationary or I(0). Hence, unit root tests like the Augmented Dickey-Fuller (ADF) and the KPSS proposed by Kwiatkowski et al. (1992) are helpful in delineating the relevant product market for competition law enforcement purposes.

In applying the method proposed by Forni (2002) the log-transformed price ratios for the categories of beverages are first calculated, then both the ADF and the KPSS tests are applied to the relative prices. If the unit root tests suggest that the log-transformed relative price of two beverages categories is non-stationary, then the two categories of beverages are considered distinct product markets. In contrast, if the log-transformed price ratios are stationary this suggests that the two beverage categories are a single product market.

The final test conducted in this paper is one of causality. Slade (1986) proposed this statistical method for the exercise of market definition to test the hypothesis that price movements in one product might have discernible effects on price movements in another product (see Massey, 2000). Based on the seminal paper by Granger (1969), if the price of product *Y* is better predicted by including past prices of product *X* than by not including them then the price of *X* Granger-causes the price of *Y* and the two products belong to the same relevant market. An advantage of the Granger causality test is that it allows for causal inferences to be made between price series while the price correlation test cannot. The Granger causality test also allows for dynamic interaction among price series (i.e. 'lagged' effects might be at work), and the analysis of the causal relationship between several price series at once.

2.2 Data

This study uses average monthly retail prices for three categories of beverages sold in Barbados during January 2012 to July 2015. The first group of beverages was 16 Fl. oz. soft drinks which comprised Coca-Cola, Sprite and Busta. The second category was beer, which comprised Banks Beer, Carib Beer Lager and Heineken. Rum was the third category of beverages,[7] which comprised the Special Barbados (700ml), Mount Gay Eclipse (750ml) and Cockspur Five Star (750ml) brands. Monthly retail price data were obtained from the Barbados Statistical Service (BSS) for the individual beverages listed above, from which monthly averages for the three drinks categories were calculated. All of the average monthly price data series were deflated using the 2012 retail price index to account for inflation,[8] and transformed into natural logarithms to reduce scale effects (see Appendix 1). A limitation of the paper was acquiring a

[7] For a better comparison to Zipitría (2009), it would have been ideal to use price data on wine in Barbados. However, upon review of the price data obtained the brands of wine reported on were not consistent and changed throughout the period under review. The inconsistency in the sample could cause in unreliable averages calculated.

[8] Inflation is a common factor that affects the prices of all commodities. If not addressed, it could, therefore, result in spurious positive correlations among the variables.

longer period of data as variables might be uncorrelated in the short-term but correlated in the long-term.

Table I presents descriptive statistics for the calculated average prices of the three above mentioned categories of beverages sold in Barbados. The table shows that in nominal terms, the average retail prices of beer and soft drinks in the country increased moderately over the 43-month period by 3 percent and 5.9 percent, while the average price of rum increased significantly by 17.1 percent. However, in deflated or real terms, the average retail price of soft drinks and rum increased by 1.4 percent and 12.2 percent, while the average retail prices of beer declined by 1.3 percent. This aspect of the data highlights the significant impact of inflation on the average prices used.

Table I. Descriptive statistics for the sample of price data

	Beer (Nominal)	**Rum (Nominal)**	**Soft Drink (Nominal)**	**Beer (Deflated)**	**Rum (Deflated)**	**Soft Drink (Deflated)**
Jul.2015 % increase over Jan 2012	3.0	17.1	5.9	-1.3	12.2	1.4
Mean	2.61	19.13	1.78	2.54	18.64	1.73
Maximum	2.72	20.52	1.82	2.63	19.85	1.78
Minimum	2.50	16.93	1.69	2.44	16.93	1.67
Standard Deviation	0.06	0.87	0.02	0.04	0.63	0.03
Skewness	0.02	-0.52	-1.68	-0.28	-0.37	-0.35
Jarque-Bera	2.22	2.26	38.29	0.62	1.01	2.20
P-value	0.33	0.32	0.00	0.73	0.60	0.33
Observations	43	43	43	42	43	43

Table I also reveals that in nominal and deflated terms the average monthly prices of rum in Barbados fluctuated more than those of beer and soft drink. This volatility can be observed from the reported standard deviations, which for rum are higher than the similar statistics for the other two categories of beverages. In contrast, the table shows that of the three categories of beverages, the average monthly prices of soft drinks displayed the least amount of fluctuation as reported by the smallest standard deviation (0.02).

Another method of assessing the fluctuations in the three price data series is to look at the skewness coefficient, which provides a measure asymmetry. For the nominal prices the skewness is positive and almost zero for beer while it is negative for rum and soft drinks. This suggests that for beer the average retail prices symmetrically take values above and below the mean (BBD 2.61), while the values of the average prices for rum and soft drinks are more often positioned below their means (BBD 19.13 and BBD 1.78). The table, however, shows that in deflated terms, the negative skewness coefficients for all three categories of beverages suggests that the values of their average prices are more often positioned below their means.

3. Empirical Results

3.1 Correlation Analysis

As stated in the previous section, the first step in conducting the correlation test is to examine whether the price data series are stationary. In this respect, Table II presents the results of the ADF and KPSS unit root tests used this analysis. Based on the results, both in nominal and deflated terms, the monthly price data series for soft drinks are stationary with a drift. The deflated average monthly price of beer is also stationary with a drift but stationary with a drift and a linear deterministic trend in its nominal form. Both nominal and deflated prices of rum are stationary with a drift and a linear deterministic trend. Therefore, the nominal average monthly prices of beer and rum, and the deflated price of rum were all de-trended using a simple deterministic trend and correlation tests subsequently performed.

Table II. Unit root test results for the price data series in nominal and deflated form

Sample	Variables	ADF	KPSS	Nature of the test	Decision
Nominal	Log Beer	-5.228***	0.083***	Intercept and trend	Trend stationary
	Log Soft drinks	-4.885*	0.572***	Intercept	I(0)
	Log Rum	-4.399***	0.122***	Intercept and trend	Trend stationary
Deflated	Log Beer	-3.357***	0.179***	Intercept	I(0)
	Log Soft drinks	-3.119***	0.309***	Intercept	I(0)
	Log Rum	-4.105***	0.052***	Intercept and trend	Trend stationary

Note: *, **, *** indicates rejection of the null hypothesis at the 10%, 5% and 1% levels of significance

Table III provides the results of the correlation tests for both the nominal and deflated price data series. The table shows a statistically significant and low negative correlation between the nominal average monthly beer and soft drink prices. It also shows that the correlation between nominal average monthly beer and rum prices is positive and statistically insignificant. The table further reveals that using deflated average monthly prices, the pair-wise correlations between beer and soft drinks, and beer and rum are low and statistically insignificant. Overall, given that the correlation tests for both nominal and deflated price data series yielded no statistically significant coefficients equal to or above the threshold of +0.8, the analysis suggests that the three categories of beverages are separate product markets.

The conclusion on the relevant product market for the three categories of beverages based on the correlation test is consistent with that of Zipitría (2009). However, it is important to note that the characteristics of the price data series used in this study and that of Zipitría (2009) are different. For instance, while the nominal logged price data for Barbados was stationary and showed low correlations, in the study of Uruguay the nominal logged prices of beer, soft drinks (soda) and wine were non-stationary and highly correlated. The similar conclusion on the relevant product market might, therefore, suggest that as an empirical method, correlation tests applied to different data sets with distinctive characteristics, could yield consistent results and might prove useful in competition assessments.

Table III. Correlation matrices for the price data series in nominal and deflated form

	VARIABLES	Beer	Soft Drinks	Rum
Nominal	Beer	1.000		
	Soft Drinks	-0.269*	1.000	
	Rum	0.012	0.352**	1.000
Deflated	Beer	1.000		
	Soft Drinks	0.088	1.000	
	Rum	0.192	0.509***	1.000

Note: *, **, *** indicates level of significance at the 10%, 5% and 1% levels

3.2 Stationarity test

For this analysis, the unit root tests were conducted for the log-transformed price ratios in levels. According to Forni (2004), this eliminates common effects in series and in particular inflation. Appendix 2 presents a graphical plot of the three logged price ratios which are: beer/soft drinks (BS); beer/rum (BR) and soft drink/rum (SR). From a visual inspection of the graphs, BR and SR appear to be following a downward trend, while BS shows a volatile but somewhat upward trend.

Following the method proposed by Forni (2004), the unit root tests performed for the price ratios are reported in Table IV. The table shows that the ADF test found BR to be stationary with a drift while the KPSS test found the price ratio to be stationary with a drift and deterministic trend. A visual inspection of the graph of BR led to the conclusion that a deterministic trend was present in the price ratio. For the other two price ratios, both unit root tests agreed that BS is stationary with a drift and SR is stationary with a drift and deterministic trend. Contrary to the results of the correlation tests, the unit root tests suggest that beer is in the same relevant product market as soft drinks and rum. The results also contradict those of Zipitría (2009) where all the logged price ratios non-stationary which led the researcher to conclude that beer is a distinct product market from soft drinks and wine.

Table IV. Unit root test results for the log-transformed price ratios

Variables	ADF	KPSS	Nature of the test	Decision
LN (BR)	-4.253***	0.843	Intercept	Trend stationary
LN (BS)	-4.189***	0.396***	Intercept	I(0)
LN (SR)	-3.912***	0.082***	Intercept+ trend	Trend stationary

Note: *, **, *** indicates rejection of the null hypothesis at the 10%, 5% and 1% levels of significance

It is important to note, however, that the results of the unit root test in this study should be viewed with some scepticism as an important concern raised by Hosken and Taylor (2004) about the reliability of the test is highlighted. This concern is that when the original price series themselves are both stationary, it is more likely that their price ratios will also be stationary. As such, in these instances, the test provides inconclusive results. Therefore, according to Boshoff (2011), a conclusion of a single market can only be determined if at least one of the original price series is non-stationary and that price series are not subject to common shocks according to other evidence. In this regard, given that the original price data series are all stationary, the test results of the stationarity or unit root test in this study are deemed inconclusive.

3.3 Granger-causality test

As a preliminary step to the causality analysis, the optimal lag length for the VAR model must be chosen. The number of lags is set at 1 as suggested by the Akaike, Hannan-Quinn, and Schwarz information criteria. Table V shows the results of the causality tests.

Looking at the results of the Granger-causality tests, there is no evidence to suggest that in Barbados there is a causal relationship between the average monthly prices of beer and the average monthly prices of the other two categories of beverages. This is concluded from the p-values which are all above the 10 percent level, leading to the null hypothesis in each case not being rejected. Based on these tests results beer would be considered a separate market from soft drinks and rum.

Table V. Granger causality test results

Causality	***X^2 statistic***	***P-value***
Beer price does not Granger-cause Soft drink price	1.707	0.191
Beer price does not Granger-cause Rum price	1.481	0.224
Soft drink price does not Granger-cause Beer price	0.009	0.925
Rum price does not Granger-cause Beer price	0.523	0.469

4. Conclusion

This paper considers the use of price tests in delineating the relevant product market for competition policy law enforcement purposes. Applying three conventional empirical price tests to price data for beverages sold in Barbados, it concludes that beer is a distinct product market from soft drinks and rum. The finding is consistent with the decisional practices in the US and the EU where, using the traditional SSNIP test, beer is considered a distinct product market from other beverages.

The paper, however, notes that applying the unit root test to the price series used yielded inconclusive results. This finding confirms the importance of using a battery of tests while delineating the relevant market. It is also suggested that price tests serve as confirmatory tools during the market definition exercise. In other words, competition authorities in CARICOM should use price tests to generate conclusive quantitative proof on market boundaries to support the intuition provided by anecdotal evidence.

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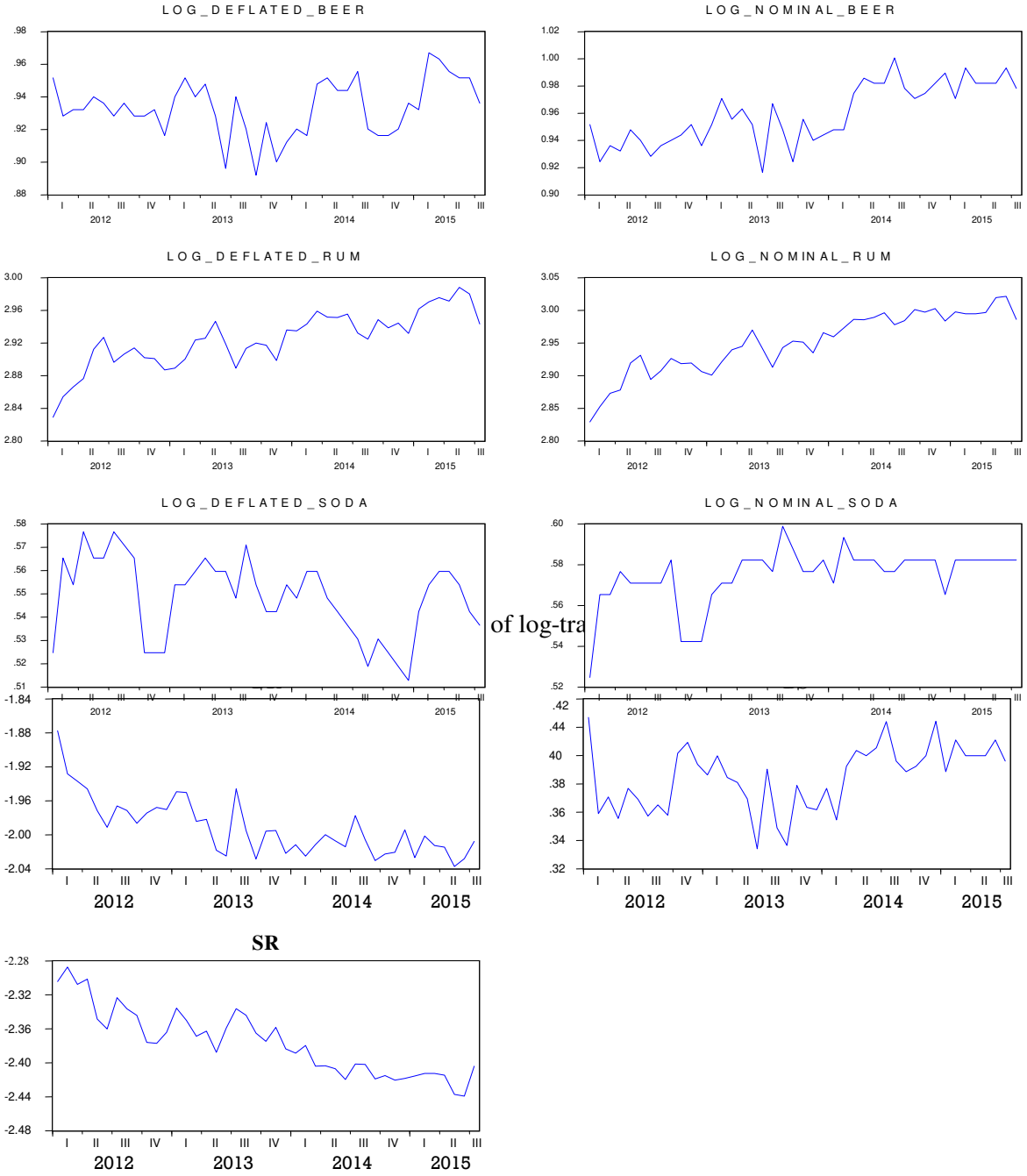
Appendix 1. Plot of logged nominal and deflated prices



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